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MEDICAL AND CHEMICAL
E S S A Y S.

[PRICE THREE SHILLINGS AND SIXPENCE, IN BOARDS.]



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Thos Moffat

MEDICAL AND CHEMICAL
E S S A Y S.

CONTAINING

ADDITIONAL OBSERVATIONS ON
SCURVY, with Cases and Miscel-
laneous Facts in Reply to Dr.
BEDDOES, and others, who have
supported the Pneumato-Chem-
ical Pathology of the Author
in his former Work.

COMMUNICATIONS from NEW
SOUTH WALES, on SCURVY,
and other interesting Subjects.

The CASE of a BLUE BOY belong-
ing to his MAJESTY'S Ship
LONDON, who died at HASLAR
HOSPITAL, with the Appear-
ances on Dissection.

THOUGHTS on the DECOMPOSI-
TION of WATER, and a Method
of preserving it pure and sweet
in long Voyages, with Experi-
ments.

BY THOMAS TROTTER, M. D.

PHYSICIAN TO HIS MAJESTY'S FLEET UNDER THE COMMAND OF
ADMIRAL RICHARD EARL HOWE.

IN SCIENTIIS NON AMICOS SED VERITATEM SECTOR.

ALPINUS de Med. ÆGYPT.

L O N D O N :

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P R E F A C E.

THE following work is offered to the public at this time, because the facts which it contains are of some importance to the present prevailing chemical philosophy. On the subject of sea scurvy, I have made such experiments, as have been suggested by different physicians, since the publication of my Theory of the Disease. They have not added to our list antiscorbutics. My recent practice has not tended to weaken any of

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my former arguments ; on the contrary, I have reason to think they have gained fresh support. It appears, however, that the subject is much exhausted, and I am now willing to leave it: I shall, nevertheless, be always ready to avail myself of any information that future experience may put in my power.

These thoughts have been put together since the arrival of the fleet into port. If any of the chemical facts to which I have appealed in the course of the work, should be superseded by later experiments, I beg it may be imputed to that want of communication with the progress of science and literature, which a physician attending a fleet at sea must frequently experience.

All my experiments on preserving water at sea, are contained in this volume: I conceive

ceive the subject to be one of great national importance, and a vast acquisition to our navy.

It was my intention to have offered some plan for converting our two Royal Hospitals into seminaries of medical and surgical education, for gentlemen to be employed in the navy. There is a something in the practice of medicine so connected with the study of it, that all hospitals where it has been tried, have found it conducive to the interests of humanity. There also has long been much real ground for complaint against the encouragement given to navy surgeons, by which means, improper people, it is said, have been admitted to the station.

It therefore appears to me, that the service could no where be so well supplied, as by an institution of this kind; and every

surgeon, in his turn, should be obliged to operate in the public room. It is the spirit of emulation that leads to excellence, and the collision of opinions generally begets a desire for increasing knowledge. Whether this department of the navy, is already so complete as to stand in no farther need of alterations, will best appear from the following narrative.

I lately visited an hospital (it was not Haslar Hospital) where the external appearance indicated the delinquency of service, and indolent habits that prevailed within. The grass-plats were crossed by slovenly footpaths, and the gravel walks were overrun with weeds. In one of the physical wards of this hospital, were upwards of twenty men, whom it was my official duty to enquire after, every second day. During thirty days of this attendance, the physician
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of that hospital saw these men *three* times, and they were seen *once* a day by an assistant dispenser. One man died, I left another on the verge of dissolution, and others variously ill. The nurse was always present when my enquiries were put to the people, in order that their medical attendants might be informed what my visits meant. It was thought, that these gentlemen to save their own credit, would assume a merit they did not possess, and look a little oftener at their patients, when they knew a physician to the fleet occasionally among them. It had no such effect: they are callous to the sufferings of our people. I was taken by surgeons of ships into surgical wards, where I found that the dressing of *every* sore was left to the nurses. I would not bloat the page of a work devoted to the relief of seamen, to relate some particulars in such cases. In these visits I was no officious inquisitor;

there was no necessity for prying, the insolence of office was audacious enough to be practiced in the face of the service, and in open day: had I been silent on the occasion, and overlooked such enormities, I should have been considered as participating in the iniquity of the transaction. It has been said, that the pay of the medical department in naval hospitals is too small: an increase of it, was one of the first proposals I made, when alterations were thought necessary. But how far this will justify a total dereliction of the duties of the station, is another thing. I am apt to believe, when some of these gentlemen shall, on a sick-bed, feel the pangs of disease, that they have not very tenderly sympathized with in others, they will wish that they had lived on king's pay, though in virtuous poverty. They will say, shame on the avarice that made them prefer the guinea of a rich patient

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tient to the blessing of a broken sailor. There is, however, one resource left; and that is, to consign their whole property to the chest of Chatham: if it cannot restore to an injured country, the limbs of her defenders, which might have been saved by their more regular and due attendance, it may at least purchase them crutches to carry them round the world!—Such language as this, may to some appear unworthy of the gravity of scientific discussion; so do I think;—but I am speaking of men, who seem dead to every human feeling, only to be roused by uncommon means, and no epithets can be too severe to mark such accumulated and accumulating depravity. What I have undertaken in this business, was not formed in the heat of a temper, naturally warm, to serve either the purposes of a visionary theory, or affected refinements in medical practice, but from a real

conviction and necessity of its utility, founded on cool deliberation, from facts in my possession. The first change that ought to take place should be the appointment of officers, to preserve order and obedience. It seems a little strange, that ever two thousand seamen should be trusted in one hospital, where there is no military government, and where no kind of punishment can be inflicted. This carries so solemn an appeal to the welfare of service, that we should think it can no longer be delayed: the turbulent spirit that has shewn itself already in some of the ships, ought to accelerate the measure. Till then, we cannot hesitate to pronounce these institutions, the source of much immorality to the men, and the grave of discipline to our fleets; not always the *asylum* of affliction, but too frequently the retreat of indolence. The dearest interests of his Majesty's navy, are
involved

involved in this discussion, and the object to be obtained is worthy of a Howard.

In the course of last summer, the chief diseases in the Channel fleet were fevers, occasioned by mixing the French prisoners with our sailors. These, with my former experience, have added much to our stock of information on Contagion. The arrangement, however, will require years; and the period is distant, when I may have it in my power to thank those gentlemen, in the name of the service, who have honoured me now and then with their communications, and to appreciate the value of their remarks.

PORTSMOUTH,
December 26, 1794.

ADDITIONAL OBSERVATIONS

ON

SCURVY, &c.

SINCE the publication of the second edition of my work on Scurvy, the Theory of Pneumatic Chemistry, as there offered, has been supported by different authors, and extended to other diseases. Among these, Dr. Beddoes has chiefly distinguished himself; and he seems to have entertained ideas, almost similar to mine, nearly about the same time, although utterly unknown to each other. But while I had the advantage

tage of collecting facts on the subject of Scurvy, he had superior advantages to me, in improving and extending the doctrine which I had adopted. A situation infinitely more favourable to philosophical retirement, a knowledge of Chemistry inferior to none in our age, a love for the study and a desire to reduce it in practice, to the relief of his fellow-creatures, have brought us to an æra in the history of medicine, that has unfolded to our view, secrets of nature, on which our predecessors in science, were not even able to form a plausible conjecture.— It is our duty to draw philosophy from the laboratory of the chemist, and make her subservient to the practical purposes of life.

At the time of publishing my Observations, I had many difficulties to encounter, and probably had not sufficiently studied
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the new doctrines of chemistry, so as to enable me to apply them with exactness to the disease on which I was treating. There were, moreover, none of my acquaintance on the spot, that troubled themselves with the discoveries of the French chemists, so that from this quarter I was to receive no assistance. Under these disadvantages, and from the work itself being hurried through the press, in a few weeks from the time, I first began to compile it, some mistakes had crept in, that were soon detected by myself, and did not escape Dr. Beddoes, and others. This is particularly the case, where I mention the attraction of oxygene for the different radicals; and thus, I certainly misunderstood the table in the *Methode Nomenclature Chimique*. My knowledge of the French language is very imperfect; but the oversight just noticed, had little to do in support of my general opinions.

Dr.

Dr. Beddoes, in page 48 of his book *, remarks, that I had confined my doctrine, to the oxygenation of the blood alone. I have no doubt, that the deficiency is general to the system, but it is of little consequence, if the muscular fibre and other parts are oxygenated through the intervention of the fluids. When a patient in scurvy expires suddenly, on exposure to the common atmosphere, after being moved from the sick birth, the lower deck, but especially the cable tier, are we to attribute this instant extinction of the vital principle to the excessive stimulus of oxygene producing indirect debility? This kind of death is attended with vast oppression about the breast: probably so large a quantity of oxygene, all at once, supplied by the lungs, speedily ex-

* Observations on the Nature and Cure of Calculus, Sea Scurvy, &c. Murray, London, 1793.

hausts the irritability of the heart; and the muscular fibres of that organ being no longer able to propel the blood, it is accumulated in the lungs, and causes the appearance just described. This effect does not follow if the air is more gradually admitted, and it may in some degree be prevented by a horizontal posture. The poor negroes in the African ship frequently went off in this way: the air in the slave rooms was so abundantly loaded with azote, or to speak more correctly, was of so low a quality, that the transition from the one to the other, was too great to be done all at once, and proportionally fatal.

But Dr. Beddoes, and his associates in these researches, would appear to assert, that this *Gas*, so necessary to support the vital principle in animals, was really that principle itself. If this is the case we are
indeed,

indeed, “*Divinæ particulæ auræ* ;” and the same foul or oxygene that is now influencing me to write a Treatise on Sea Scurvy, may in a few months be administered to cure it, in a sailor, through the medium of an orange or lemon.

I feel the full force of the arguments adduced by the learned Chemist, against my position, that scurvy is produced, “from a deficiency of recent vegetable matter *alone*,” and that the oxygene is by this means abstracted from the body. Thus, we should have expected, that a change to a purer air, would be sufficient to restore the lost principle, by respiration. But we well know, that this does not take place ; for if the scorbutic symptoms have got to a certain height ; (the precise degree of which, I cannot determine,) unless fresh vegetable matter is immediately taken in, death will inevitably follow.

follow. How else did Dr. Lind let his scorbutic patients die at Haslar Hospital, from the dissection of whom he gave us the morbid changes in the body. Now, if a pure air is to be found any where, it is in the clean and spacious wards of that hospital: and if there is a disease, that I would venture to say, I can cure to a certainty, it is the one in question. I own this part of the subject embarrassed me not a little; for how could we suppose that any kind of diet could subtract a principle from the blood, with which the lungs was every moment supplying it? I allow with Dr. Beddoes, that impure air will very much assist in producing scurvy; but I must pause there. There is no case on record, where such symptoms appeared, merely from breathing an atmosphere, not duly affording oxygene; and before scurvy would appear through this process, some other disease would put

an end to life. We have therefore a right to conclude, that the vital air supplied to the circulating mass by the food, is destined to purposes in the animal oeconomy, different from what is taken in by the lungs; and that they have each their distinct diseases when deficient. But the worst air that is met with in a ship, is either in the hold, or in the steward-room. Now, the men most employed in the former place, who are, commonly a quarter-master with his gang, I have never found particularly disposed to scurvy. A purser's steward, who lives much below in the steward room, has generally a complexion that indicates the polluted atmosphere he breathes among cheese, butter, and candles, constantly burning. Yet among people of this description, I never saw a case of scurvy, which may reasonably be attributed to their better fare, and being able to afford them-

themselves tea, sugar, and vegetables. I have, however, frequently remarked, that the steward and assistants in the bread-room, are very liable to hypochondriasis, which no doubt often attends scurvy, but here appears to me to be the primary disease. Most people subject to hypochondriac affections indicate from their colour a deficiency of oxygene; but there are certainly peculiarities of constitution, that must occasionally modify the effect of external causes, be what they may in exciting diseases.

Dr. Beddoes is altogether misinformed, when he says, “ It appeared therefore probable to me, that, as seamen in general breathe an air containing a smaller portion of oxygene than other description of persons, the scurvy might often originate from this cause*.” The gene-

* Page 53.

ral practice in our ships by no means admits of the conclusion. In harbour, windfails, ports or scuttles in the sides, abundantly ventilate the decks : at sea, the motion of the ship, windfails, scuttles, and occasionally ports, answer this purpose ; to all these means may be added, only one-half of the ship's company being below at a time. For my part I am fully persuaded, that seamen in general breathe the purest air.

It was Captain Cook's custom to divide his ship's company into three watches, whose modes of discipline, Dr. Beddoes and others view with partiality : yet, on the Doctor's own ground, this was unfavourable, as more people were below at a time, than if there had been only two watches in the ship ; and of course, there would be a smaller proportion of oxygene to supply their respiration. But, perhaps, Dr. Beddoes

does might reply, other advantages compensate for this, for the oxygene would accumulate by rest and a longer respite from duty. Dr. Milman lays great stress on the prevention of scurvy, on Captain Cook's three watches*. Among constitutions, such as his medical practice enables him to judge of, the puny inhabitants of London, or bodies enervated by luxury in high life, such exertion would no doubt soon induce diseases of debility. But the hardy and vigorous seaman, yields to no such trifles. We who see things on the spot, and daily accustomed to reason on the discipline of ships, are clearly decided in favour of two

* Upon inquiry of Captains Bligh and Portlock, I find their last voyage for the bread-fruit tree, afforded no experience on this disease. But ships fitted for these purposes ought not to be compared with others in time of war. They are manned by volunteers, and generally seamen. Our ships on West India stations, in peace, enjoyed the best health; but very different has been the state of others during the war.

watches ; our most accomplished and intelligent officers have also, from experience, put it beyond dispute. Sixteen idle hours out of twenty-four, will be apt to induce diseases, that accompany indolence and inactivity of both body and mind. It ought to be remembered, that the sailor is no sooner off deck, and in bed, than he falls asleep. He has no mental irritation to retard his repose, his mind is not stored enough with reflections to excite painful sensations. Such is not the case with the two great physicians I have lately mentioned, anxious for the effect of a medicine, the fate of a patient, or the decision of an experiment. The sailor gets up with equal indifference, for early custom has brought it to be habit with him ; and he loses nothing of his sleep, whether he has it all at once, or only for four hours at a time. An officer of address will always be able to manage this
temper

temper of seamen to the advantage of their health. “ They are,” it has been truly said by one of their best friends and commanders, “ in point of health mere children*,” and it is our duty to watch over them with a fatherly care.

Much commendation is due to Dr. Beddoes for his application of pneumatic medicine, to the treatment of phthisis. I hope no small obstruction will make him yield up his purpose, and though the desired success may not attend his endeavours, it may pave the way to what future enquirers may attain. The novelty of the attempt may perhaps expose him to the malignity of some not equally well disposed, and the ardor of pursuit may be branded with the name of enthusiasm ; but a virtuous mind, intent on a

* Rear Admiral Sir Roger Curtis, Bart. Captain of the fleet. See his method of extirpating an infectious fever, when Captain of the Brunswick, lately circulated among his friends.

generous action, must look upon these as so many steps to raise him to distinction; for to be either very good or very great, is to be very much envied, and very much misrepresented.

It appears to me a very material part of investigating the state of the blood in phthisis, to demonstrate by what peculiarities of constitution the vital fluid comes to be hyperoxygenated. The formation of the body, such as the long neck, narrow chest, high shoulders, fine skin, &c. and the period of life are said to have their share. The respiration in such persons is more easily hurried than in others, and it would seem that they inspire with greater rapidity than they expire. Some external circumstances ought also to be considered, such as situation, whether elevated or low ground; in the town or country; the diet or food; the trade or employment, as flax-dressers,

dressers, millers, stone-cutters, &c. The people whom I have remarked most liable to this disease, from their employment, are our fifers. Besides accompanying the drum at the regulated hours, it is a practice in ships of war to employ the fifer when any piece of duty is going on that requires hoisting; such as getting up the lower yards, heaving the capstan, and receiving provisions. The tunes on these occasions are all quick marches, to keep time with the run of the sailors along the deck; consequently the exertions of the lungs in blowing a wind instrument with such rapidity, for hours together must be very great. Do the lungs by this quicker motion of expiring and inspiring, receive more oxygene than they do on common occasions? It is a cruel practice, and therefore some other instrument of music ought to be substituted.

Dr.

Dr. Beddoes appears to me perfectly correct, when he says, that seamen are very little troubled with phthifical complaints. Consumptions can scarcely be reckoned among their diseases, although five-sixths of the seamen in a man of war, are of an age within the phthifical period. Some cases of consumption have lately come under my observation; but they were few compared with the number of the fleet, and the bad weather they had before experienced.

I cannot, however, suspect this exemption from such complaints to be owing to the air they breathe, having less of the respirable quality, but rather to their diet. Let it be now recollected, that the unfortunate Africans were cured in a ship, while they slept in the polluted rooms of a Guineaman; the cure was, nevertheless,

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as quick and complete as it could have been in the well-aired apartments of Haflar Hospital.

Can the medical gentlemen who attended the brave garrison of Gibraltar during the siege, inform us whether phthifical complaints disappeared among their men as the scurvy gained ground?

Having made these preliminary observations, I am now to arrange in order the facts which very late experience has put in my possession.

In February 1793, I was moved from the Centurian to the Vengeance of seventy-four guns, then at Spithead, and fitting to receive

receive the broad pendant of Commodore Charles Thompson, now Rear Admiral; and intended for the Leeward Island station. The work of Dr. Beddoes was put into my hands, by good luck, about this time. In relating the diseases of a ship's company, it is always proper to preface a history of her station, &c. The Vengeance had been a guardship at Chatham, and on the breaking out of the armament, December 1792, was ordered to complete her men to six hundred, for actual service. About two hundred were therefore added to her former establishment, and nearly three-fourths of that number were raw Irishmen of the worst description. In January she sailed from the Nore, and at this time received a large draft of men from the Nemesis frigate, to carry to the fleet at Spithead. Among these people were two ill of the jail fever, who communicated the infection to most of the

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the ship's company; and it was not till we were to the southward of Madeira, that she was clear of the sickness. There were many singular circumstances attended the progress and extinction of this fever, which will be elsewhere noticed, but they had little to do with cases of scurvy that occurred in the Vengeance.

It is a difficult, if not often dangerous attempt to reconcile appearances in the living body, to the laws of chemical affinity. In the fond attachment to this bewitching study, amidst the enthusiasm of enquiry, we may be sometimes betrayed into imaginary facts and fallacious conclusions. But divesting myself of all partiality for a favourite opinion, I can have no doubt that the good effects of the citric acid in the cure of scurvy, are entirely owing to its imparting oxygene to the blood, however
difficult

difficult it is to make it agree with experiments out of the body, because the sulphuric and other acids are not found to have the same effect in curing the disease. Dr. Beddoes does not easily yield to the exception of the other acids, and tells us that the elixir of vitriol was an improper form. This must be readily granted, for acids diluted with ardent spirit, certainly no longer retain the quality they possessed before.

It is to be remarked here, that all the experiments I am now to relate on the subject, were made while the ship was at sea, and when no fresh vegetables could be procured. This in point of accuracy will give them a preference to those made by Dr. Lind at Haslar Hospital.

DILUTED

DILUTED SULPHURIC ACID.

Robert Bell, aged thirty, a seaman, and was impressed : his symptoms of scurvy were spongy gums, hardened and contracted hams, livid spots on the thighs and legs ; very much depressed in spirits, and apprehensive. He is to take the vitriolic acid, diluted with water, in as great quantities as his stomach and bowels will bear, without pain. This medicine was continued for a week, during which time the symptoms became gradually worse. It was then changed for the juice of limes, which in a few days effectually cured him.

For a day or two at first Bell had better spirits, and looked more lively ; but it did not continue. The effect of lime juice was, as I have generally observed, apparent in twenty-four hours. Five cases of nearly
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the same description followed the above ; the result was exactly the same.

CONCENTRATED ACID OF TARTAR.

First day. William Casey, aged twenty-four, a landman. Symptoms of scurvy are lameness, contracted tendons of the knee joint, large livid spots on the legs and thighs, difficulty of breathing, great dejection of spirits, &c. He had the fever sometime ago, and went through a course of mercury for the venereal disease, in the passage out. In a note, in my book, under this man's case, is the following remark. " This man is a very fit subject for experiment, " as all my fruits are now expended." The ship at this time was cruising off Guadeloupe ; for had I been in a situation to command limes or lemons, I should not have
thought

thought myself justified in making comparative trials of any articles in this man's complaints. Patients affected like him will often drop from our hands when we very little expect it.

He is to take a pint of water, to which is to be added, concentrated acid of tartar, sufficient to give it the usual acidity. What I mean by the usual acidity, is enough to endanger gripes in the bowels, without however effecting them. This has always been the only rule adopted in exhibiting the citric acid. Two drams of the concentrated acid of tartar give a sharp taste, if well prepared, to a pint of water.

Second day. Complains less of pain, and appears in better spirits than yesterday.

Third day. No change for the better: complains much of pain and weariness.—
Let the quantity of acid be increased.

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Fourth

Fourth day. No variation from yesterday.

Fifth day. Feels no relief from the medicine, is scarcely able to walk.

Sixth day. No apparent symptoms of recovery. This day the ship came to Dominica, where the fruits and vegetables that were with difficulty procured, soon recruited the health of this man and others.

Another case, though not so inveterate as Casey's, was treated at this time in the same way, and was similar in its issue.

NITRE.

First day. The subject of the last case, William Casey, about five weeks from the time he was cured as above, was affected with scurvy in a manner almost like his former symptoms.

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The ship was now on her passage to England, but from the very short time that was given us to prepare for the voyage, it was not in my power to procure either fruits or vegetables for the use of the sick, in sufficient quantity.

This man was ordered to take two drams of nitre very well diluted throughout the twenty-four hours.

Second day. No better.

Third day. Says he is rather worse.—
Let the quantity of nitre be increased.

Fourth day. Scorbutic symptoms evidently gaining ground.

Fifth day. Limbs more swelled, and the knee joint more hard and contracted; livid spots growing of darker colour. Let him take the nitre for one day more.

Sixth day. All symptoms worse; pains all over him, and worst when in bed.

ACETOUS ACID.

Seventh day. Let him take eight ounces of vinegar diluted with water, in the course of a day.

Eighth day. Has taken half a pint of vinegar since yesterday, without gripes.— Says his legs are harder and stiffer.

Ninth day. Says he is easier as to pain; but no appearance of being better. Found that I had been giving him vinegar, in consequence of which he took a full pint more, which he got from different messes; it being at this time served to the ship's company.

Tenth day. The quantity of vinegar taken a pint and a half, yet he feels no effect from it.

Eleventh day. Thinks he is easier, but no external symptoms of it. He now takes a quart of vinegar.

Twelfth

Twelfth day. Much worse to day, in all his symptoms of scurvy. Quantity of vinegar the same as yesterday, but does not affect his bowels. He is to continue it one day longer.

SUGAR.

Thirteenth day. Says he is always worst in the morning, and got up to day much more fatigued than when he went to bed. His teeth are growing loose; the knee is very much contracted and black. Let him take eight ounces of good soft sugar in the day.

Fourteenth day. Much the same; not purged by the sugar; let him take ten ounces to-day.

Fifteenth day. Getting worse; let the sugar be tried for only one day more.

Sixteenth day. No better. Let him now take two ounces of lime juice in the day. The weather feels cold at this time, about the middle of September, from a northerly wind. My stock of lime juice now consisted of seven bottles, and about one hundred and fifty limes; I could not therefore give a larger dose, as other cases were appearing. This man recovered, but there was a necessity of increasing the acid.

A case or two more were treated with nitre and vinegar, and another with sugar, in the above quantity. The symptoms during their use seemed to grow as quickly as if no medicine had been given.

SPRUCE BEER.

First day. Richard Williams, a young man. Had the fever some time ago, but
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is grown remarkably fat. He is cook's-mate, and was accustomed to make free with the slush tub. Slush is the fat of the salt meat, skimmed from the water that boils it. At my request it was forbid to the ship's company on leaving England. In this man, as is usual in all corpulent habits, the scurvy advanced quickly, and the symptoms are peculiar. His looks have much of the dull bloated appearance, with a greenish hue round the eye and mouth. He is extremely averse to motion; the legs are much swelled, pitting on pressure, and rather red than livid.

Let him take a pint of spruce beer three times a-day. The officers had some at this time of the best quality.

Second day. No change for the better; appears quite in a state of indifference.

Third day. Rather worse: he is to take

the spruce beer only one day more. It is too severe a case to carry farther.

Fourth day. Still worse. His teeth are now loosening, and nearly dropping from the jaw; gums very black and spongy: his spirits are very depressed, he thinks himself dying. Let him take the lime juice in as large doses as it can be spared.

Fifth day. He already feels relief. In the space of a week, he became emaciated, was very weak, but the scorbutic symptoms yielded in due time.

ACID OF TARTAR.

First day. John Hufley, a landman. His symptoms are lassitude and debility, swellings of the lower extremities, yellow and livid blotches in the inferior part of his thighs, bloated countenance, foetid breath,
spongy

spongy gums, teeth loosened, &c. Let him take the acid of tartar diluted.

Second day. No alteration ; no griping or purging from the medicine. Let him have, besides, a pint of porter in the day.

Third day. Symptoms worse, pains more severe.

Fourth day. As before.

Fifth day. Scorbutic symptoms increasing. Let him have limes sparingly, as our list now increases.

He grew better, but was not cured till in port.

DILUTED SULPHURIC ACID.

First day. — Quinlan, a landman, complains of the general scorbutic symptoms of some days standing, and is not able to walk. He is to take the diluted sulphuric acid.

acid. A pint of porter a day is likewise sent by the Captain to all the scorbutics.

Second day. Greater dejection of spirits, and looks ill.

Third day. Symptoms advancing rapidly. He is to continue the acid only one day more.

Fourth day. Has received no relief from the medicine. He is now to take the lime juice as it can be spared.

This man recovered slowly, and the disease more or less remained till we came to Spithead.

NITRE.

First day. James Harrington, a landman. His symptoms of scurvy are, great debility, lassitude, low spirits, hardness of the muscular parts of the legs, discoloration, &c.

Let

Let him take half an ounce of nitre, very well diluted, in twenty-four hours ; besides a pint of porter.

Second day. No alteration of the scorbutic symptoms, or feelings of the patient.

Third day. Thinks he is getting worse, and finds himself weaker ; some slight degree of heat and pain about the pit of the stomach, from the medicine. Let it be continued only one day more.

Fourth day. Pain at the pit of the stomach, much the same as yesterday. No relief of the scorbutic symptoms ; they are evidently gaining ground. Let him be treated as the others.

Similar trials of the above articles were occasionally repeated in different cases, as the disease occurred on our passage to Europe.

rope. The result was in all of them very much alike. The medicines were given under my own eye; otherwise, by a worthy young man, and intelligent surgeon, Mr. Peter Blair, now in the *Oiseau* frigate, to whose abilities and attention I am happy to give this acknowledgement. The cases were regularly taken down, by myself, once a day. It may be observed throughout the whole, that we always turned with confidence to the citric acid. If, however, the concentrated acid of tartar approaches near to this in its sensible qualities, or combination with alkalis; it, doubtless, does not possess its medical virtues. But had it been effectual in the cure of scurvy, it is not that cheap medicine which Dr. Beddoes mentions; at Apothecaries' Hall, it cost three shillings per ounce.

Ten ounces of sugar in the day had no antiscorbutic effect whatever. This article was tried, because I conceive, that spruce beer, and the essence of wort or malt, owe their virtues almost entirely to this matter. The spruce beer is merely sugar, scarce fermented; for we do not find it possess ardent spirit, but impregnated with the tar principle to give it flavour. The essence of wort, is the farina of barley, converted to sugar by the process of malting. Let it, however, not be understood, that for these reasons such articles ought to be neglected; on the contrary, I know them to be good preventatives of the disease.

We have also seen the Acetous Acid, taken in the form of diluted vinegar, to the uncommon quantity of a quart a day, yet
no

no advantage succeeded. Probably, in a state of health, so large a quantity, could scarce be exhibited without producing severe pains of the bowels. This was wine vinegar of the best quality.

The Diluted Sulphuric Acid was attended with no better success. In very slight cases, that I did not think worth noting, and where scorbutic symptoms could just be said to be beginning, it seemed to do good. The smell of sulphur, as mentioned by Dr. Beddoes, after the use of the acid, was not perceptible to either my patients or myself. But this was not to be perceived, unless the acid had undergone a decomposition in the body, which if it had done, the disease would be cured.

The

The exhibition of Nitre, was attended with no better success. This salt is allowed to afford oxygene out of the body in great quantities: yet uncommon large doses imparted no relief to the symptoms of scurvy.

During the time I was employed, in the experiments before mentioned, the ship's company of the Vengeance, had a quart of cocoa a man, with sugar enough to sweeten it, for breakfast, in lieu of oatmeal, butter, and cheese. Every patient in the sick list, had for supper, a pint of well prepared sowens, with wine and sugar to make them palatable. The scorbutics had, besides all these, a pint of excellent porter sent them by the Captain. Yet, even with the addition of these dietetic comforts, scurvy was
neither

neither prevented or cured. The officers of this ship, who had always plentifully shared their fresh stock with the sick, could in the present instance afford them no assistance, for it was not possible to procure as much at the islands of St. Kitt's and Monferrat, as to serve them a third of the way home. The passage was performed in about nine weeks; had it been a fortnight longer the scurvy must have made dreadful ravages, among a crew so little seasoned to service.

On our arrival at Spithead, there were thirty men tainted with the disease, some of these in the worst stage. On former occasions, I had observed the beneficial effects of apples; they were now in season, and I determined to cure the whole on board. For this purpose, Mr. Sheppard, purser of
the

the ship, paid half of the expence of a few bushels of apples, which in a week or ten days restored our men to perfect health.

Dr. Beddoes has drawn some ingenious conclusions, from my narration of the corpulent slaves being so liable to scurvy. This is again supported by the case of Williams, who was one of the cook's shifters, and had made free with the fat of the salted meat. The following very interesting communication, strongly confirms my former assertions, that the most hideous symptoms of the disease are met with, in fat subjects. Lieutenant David M'Iver, of the Vengeance, gave me this information; it happened while he was mate in the India service.

On board of the Chesterfield Indiaman,
in the year 1788, were five natives of
E China,

China, on their passage to their own country. These people were so fond of the flush, that they evaded all the vigilance of the cook to prevent them from stealing it. In the space of five weeks from the time they left England, they became extremely corpulent, and were shortly after over-run with scurvy. At this time, though there were many landsmen in the ship, yet none of the crew had the least symptom of that disease. Mr. M'Iver added, that their fatness from this practice became monstrous; insomuch, that the skin appeared as if it would burst, and their cunning to procure the flush of the meat, exceeded all description. The disease put on the most dreadful appearance, and they were not cured till the Chesterfield arrived in port. This is, no doubt, a precious fact to the Pneumatic Physician.

Here

Here end what remarks on scurvy were made on board the Vengeance.

In the month of December 1793, I was appointed physician to the Royal Hospital at Haslar. Within these walls the first Lind practiced, swelled our knowledge by his facts, and enriched the science with observations on many subjects, till then but little known. I was now to tread the same ground, although, *haud equis passibus*, where this great physician had formed his opinions. From having been a writer on scurvy before, it opened to my view a fresh field for investigation, and I was prepared to avail myself of every opportunity of information which might be offered.

The first patient in the disease, that came in after my appointment, was John Driver, belonging to the Queen Charlotte, the

ship of Earl Howe. The two wings of the hospital, containing what are called the physical wards, are attended by the physicians, the south wing by Dr. John Lind, and the north fell to my share. The Channel fleet had lately returned from a long cruise. His symptoms were inveterate, and the limbs so contracted that he could not walk. He was by the assistant dispenser put on the *Vinum Antiscorbuticum* of the hospital, the same as prescribed by Lind senior. At the time I first visited him, he had taken his medicine for two days, and was on a diet of mutton and greens: yet, he found himself worse, since he came on shore, and was confined to bed. He was immediately ordered two ounces of the citric acid, three times a day; there appeared in this case no time to lose. On calling to see him next morning, I found him still worse, and ordered him two ounces
of

of the same acid four times a-day. On the day following, I was yet more surprized, that his complaints were not beginning to yield. He was now yellow or livid all over, and his pains at night tormenting. The nurse and other people in the ward assured me that his medicine was faithfully taken. From this I was led to examine the bottle at the head of his bed, where instead of lemon juice, it was the diluted sulphuric acid. There were, it appeared upon inquiry, no juice of lemons in the dispensary: but the *succedaneum* had almost cost the poor man his life. The same afternoon, on passing a fruit woman to the hospital, I bought a few oranges and lemons, and ordered him to take the whole before my morning visit. The effect was then, as I had expected, and often seen; he was sitting in bed and supping his bread and milk, and free of pain. I now supplied him with sixteen ounces of

citric acid, concentrated by congelation. With this preparation he recovered in a few days; but it was some weeks before he could use his legs; there was indeed some hardness remaining when he was discharged to his ship.

I was cautious enough to mention this case to Mr. Robert Davies, one of the assistant dispensers, who attended my practice: it involved so many circumstances worthy of note, and it might have been suggested, that I was so wedded to favourite opinions, as sometimes to overlook occurrences that weighed equally against me.

It appears by this cure, that the citric acid, concentrated by freezing, to one eighth of its bulk, retains all the virtues of the fruit in its recent state. I had a few weeks before this, at my own expence, prepared
a quantity

a quantity of lemon juice for freezing ; but at the very time that it was fit for the purpose, my process was disappointed by a sudden thaw, and no frost occurred afterwards during the winter.

Much about the period of Driver's illness, other cases of scurvy were under cure in the north wing, attended with circumstances very similar to his ; where it appeared, that the *Vin. Antiscorbuticum* of Lind, was infinitely inferior to the pure juice ; and where neither the sulphuric acid or mutton and greens retarded the advance of the complaint.

In the beginning of March, and after I had attempted to model and regulate the wards in the north side of the building, according to my own ideas of hospital practice, a clinical ward was appropriated for

cases that appeared to be subjects for particular modes of practice. In this ward after finishing the morning visit, about twelve o'clock, I met the assistant dispensers, and with them wrote at full length, the symptoms of every patient's case, explained to them what was obscure, and gave my reasons for what might be prescribed. By these means in a few months, they would have become more valuable assistants to myself, been of much benefit to the service, and gained respectability to themselves.

Here follows the first case of scurvy, that appears on the diary of our clinical practice.

March 8th. Terrano Dun, Royal Sovereign, scurvy; not brought up to sea; has had the disease three weeks: cough, pains of the loins, contraction of the hams, livid blotches on the legs, spongy gums: has
been

been cruizing seven weeks, and had fresh provisions only two days after going out.

R. acid tartar. concent. ʒij.

aq. distillat. lbj.

M. ʒiv. quater die.

March 9th. Was in harbour some weeks at Plymouth before the scurvy appeared; thinks his gums better; no uneasiness of the stomach or bowels from the medicine; appetite good. Rep. mis. acid. tart.

March 10th. Rigidity of the hams rather increased; the spots larger, and of a darker colour. Let a drachm of acid be added to the mixture. N. B. This quantity renders the water very acidilous.

March 11th. Livid spots on the thigh spreading fast, as also the rigidity. The acid of tartar seems to have no effect.

R. acid. citric. ʒiij.

ter. die.

March

March 12th, Has taken a pound of the citric acid since yesterday ; colour of the thigh less livid ; better spirits ; pain in the breast not so bad. To-day he sits up by the fire. Rep. acid. citric.

March 13th. Recovers rapidly ; pain of the breast almost gone ; livid colour of the thigh disappearing fast, finds himself every way better. He looks much emaciated.

March 19th. Livid spots scarcely perceptible.

March 15th. Convalescent.

The concentrated acid of tartar was given in other inveterate cases, to the quantity of six drams a-day, without effect. In slight symptoms of the disease it seemed to do good ; in one of these a hemoptysis supervened ; in another case hemoptysis followed a pint of the citric acid after three days use.

On the third of April 1794, I was appointed

pointed physician to the fleet, under the command of Admiral Earl Howe, and succeeded at Haflar Hospital by my respected friend Dr. Robert Hope, who had lately received the appointment of physician to Admiral Gardner's expedition intended for the East Indies.

The following letter from Mr. Edward Laing, surgeon at New South Wales, besides the valuable information it contains on the subject of scurvy, abounds with matter so highly interesting to the medical reader, that I shall make no apology for inserting it at full length.

To

TO DR. TROTTER.

Sydney, Port Jackson, Dec. 11, 1792.

DEAR SIR,

I have received by Mr. Woodruff your welcome epistle, accompanied by your second and much improved edition of Observations on the Scurvy.

If I admired the wonderful discoveries of modern chemists, with the beautiful and accurate experiments of Lavoisier ; I must confess it gave equal pleasure to read your application of them to the practice of medicine. These discoveries, however beautiful, are only useful, as they lead to improvement in the arts and sciences.

The

The cure of scurvy established by incontrovertible facts, was certainly the best *radical* you could have chosen for the foundation of your theory; and I hope the reciprocal *attraction* between that theory and the cure will be too strong to be *decomposed* by malice or envy, which are too often roused to check the ardor of philosophical enquiries.

You desire a particular account of the scurvy in our transports, with some observations on the climate and disease of this colony. That you may be able to form some idea of the former, I will give you a sketch of our passage in the Pitt: the time I have been here does not allow me to say much on the latter; what I have seen I will briefly relate. In forming a judgment I have done it impartially, as I know that cases are frequently tortured, to answer
some

some particular theory; I declare myself biaſſed by none. Had this been always ſtrictly adhered to, we would not find ſo many contradictions in the writings of medical authors.

When the Pitt left England, on the 17th of July 1791, ſhe had on board near fix hundred ſouls; conſiſting of a company of our *corps*, her compliment of ſeamen, and four hundred and fifty convicts, or thereabouts. The ſoldiers and ſailors were lodged upon the gun-deck, the convicts on the orlop. This deck was fitted up in births to contain about five or ſix men each, with other births above them, to contain the ſame number: as the height was only five feet to the beams, theſe births could only be two feet and a half high.

This priſon-room was ventilated by a grating about eighteen inches wide, cut
through

through the gun-deck, on each side, and about two-thirds the length of the room. The ventilation of this place, was, perhaps, as nearly perfect as it could be. Windfairs were introduced down the fore and after hatches, and White's patent ventilator was kept working at the fore scuttle. This manner of fitting up a transport, is, I think, liable to one great objection, which is, that the air already breathed by four hundred people in a confined situation, and almost deprived of its oxygenous principle (and thereby rendered unfit to support animal life) ascends immediately into the gun-deck, where it is again respired by the soldiers and sailors.

In good weather, when the ports are up, perhaps no great mischief will arise from this, as the noxious air is immediately carried off by the breeze constantly passing through

through the ship ; but in bad weather, when the ports are obliged to be constantly shut, and that in a tropical climate, where the heat (even in the coolest parts of the ship) is scarcely supportable, the consequences are to be easier conceived than described. Did it not increase the violence of the fever, which raged afterwards among the soldiers and sailors ? We may observe, by the way, that the thermometer stood at 80° in the orlop, when it was only 67° in the shade on deck. I may likewise mention, that the gun-deck was very much crowded, not only by the guns, sailors chests, soldiers baggage, &c. but several packages were obliged to be put there, on account of the quantity of provisions and water for such numbers ; likewise government stores, in which we may include the complete frame and rigging of a sloop of forty-five tons.

You

You may recollect, I mentioned to you, the last time I saw you, that we had the small-pox on board when we sailed: ten convicts and two soldiers were ill of this disease. In several of the convicts they were of the confluent kind; but this was not to be wondered at, as the only place for the sick of that class, was two or three of the births before-mentioned on the orlop-deck, where the healthy and sick all breathed the same air. Our passage down Channel was not very favourable; the winds were westerly, with blowing, hazy weather. This continued till we were in the lat. of Cape Ortigal, which we saw on the 28th. As the weather now began to grow fine, and the small-pox still raged on board, I proposed inoculation to such soldiers and soldiers children as had not had the disease. This was readily agreed to, and met with the approbation of our worthy commanding

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officer,

officer, who on every occasion shews the greatest wish to promote the health and happiness of his men. I therefore performed the operation upon several (one above thirty-five years of age) who all had the disease in the mildest manner. I attribute this to their being confined to the farinaceous part of their diet, and being kept upon deck whenever the weather would permit.

On the 28th. As no more convicts had received the infection since we left England, we began to flatter ourselves that the disease had run through all those who had not had it; but I was surprized on the 29th and 30th to find six or seven more attacked all within the space of twenty-four hours. As the weather was now more favourable than it had been, my surprise was increased. On reflection I could not discover

cover

cover any satisfactory reason for this sudden re-appearance of the disease. Having heard something of *lunar influence* in fever and infection, I was induced to look into my almanack, where I found that the moon had changed about this time; and I likewise found that the first ten or twelve attacked, must have happened a month before. But not being willing to receive any opinion from a solitary instance, which might happen from accident, it only made me resolve to observe this more accurately in future.

On the 16th of August, we arrived at St. Jago, where we remained a week; during which time the seamen were employed in procuring water, which was very bad, and difficult to be got. There had scarcely been a shower of rain upon the island for three years; many of the cattle were dying for want of grafs. Several of the soldiers

and sailors, when on shore, were guilty of excess in drinking a bad kind of new rum called *aqua dente*, and, when intoxicated, they slept in the tents by the watering place, or on the open heath. The soldiers' wives were employed on shore, washing, &c. The days were intensely hot, the thermometer generally above 90° on shore; heavy dews fell at night. During our stay we got a little fresh meat, some oranges, limes, pine apples, &c. but you may suppose few or none of these fell to the share of the convicts.

We sailed from this island on the 23^d. At this time we were clear of the small-pox, in which disease twelve convicts died. Some of them that recovered had disagreeable ulcers on their legs, but they had not the appearance of being scorbutic. They were relieved by the use of bark and opium.

Till

Till the 26th we had pleasant weather; the thermometer was generally from 84° to 86° . On the 27th it began to rain, attended with thunder and lightening, which continued more or less till the 4th of September. During this time, it was generally calm, which rendered the heat almost unsupportable.

It was on the 29th of August that the remittent fever made its appearance among the soldiers and sailors. Lat. $9^{\circ} 0'$ north, long. $24^{\circ} 27'$ west. On the 3d of September, twenty-eight soldiers and women were down in this disease, with an equal proportion of seamen, and a few convicts who had assisted in watering the ship at St. Jago, and in working her during the wet weather. It is needless here to describe the symptoms; they were nearly the same as given by the best authors, only there seem-

ed to be a greater secretion of bile than in any instance I had before heard. Very early in the disease, some were affected with *delirium*, and in others it showed a tendency to change into dysentery.

While the weather continued close and wet, the disease shewed little tendency to remit; though the symptoms abated a little in the morning, the *apyrexia* was never complete, and the fever returned with redoubled violence in the evening. It was during this state of the weather that we lost most of our patients. Nature pointed out the necessity of evacuating the contents of stomach and bowels in the beginning of this fever. These evacuations seldom failed to relieve the patient; nor did they seem to induce that debility, which some authors are so much afraid of. Saline febrifuge medicines were given to bring on remission,
and

and then the bark was exhibited in different forms ; but the stomach was in general too irritable to bear it in substance.

This fever never shewed a tendency to complete remission till we got into the S. E. trade, and into cooler latitudes. At this period the bark and wine were the only medicines relied on during remission ; and I always found, that unless the remission was complete, the bark always increased the *pyrexia*. One of the soldiers, after being much reduced by this disease, when in a state of convalescence, was seized with dysentery of which he died. Few of the convicts had the disease, except such as had been exposed on shore at St. Jago, or in working the ship.

Towards the latter end of September, when we were ten or twelve degrees to the

southward of the line, I began to observe the scorbutic diathesis among them. The first symptom was a change of complexion, from a natural to that of a bloated, fallow appearance. This was at first ascribed to their greater confinement in the wet weather, and necessity of allowing but few to come upon deck at a time, on account of the sickly state of the troops. This change of complexion, with lassitude, and a seeming sluggish disposition, were the only symptoms which I observed for some time. As the soldiers took up much of my time, I had not an opportunity of observing the progress of this disease so minutely as I could now wish I had done. However, on hearing the surgeon of the ship complain of the ulcers among them from their *irons*, on examination, I found that they had put on the true scorbutic appearance so well described by many authors. The Captain of the
ship

ship intended to have run immediately from St. Jago to the Cape of Good Hope ; but from our tedious passage across the line, he began to suspect that the water would not hold out ; indeed we were now at a very short allowance. He then hinted at going to the coast of Brazil to take in a fresh supply, which measure I recommended to him in the strongest terms I was able. As we had not a single antiscorbutic on board, except a little essence of malt and spruce, our situation, had we been much longer at sea, must have been truly deplorable. We therefore bore away for *Rio de Janeiro*, which place we reached on the 8th of October, to the great satisfaction of every one on board.

From the first appearance of this disease till now, the patients grew worse in spite of every thing we could do for them. Although the ulcers put on that appearance
which

which characterizes this disease, few had their gums or hams affected. These symptoms did however take place in some. Soon after our arrival, the sick were sent to a small island, about a mile from the town, where the ulcers put on a better appearance, but did not heal so fast as they would have done, had the sick been more liberally supplied with vegetables and acid fruits.

The fever-patients had now almost all got well; a few of the convalescents relapsed into a true intermittent of the tertian type, which, however, easily gave way to gentle emetics and the bark. Some during our stay had catarrhal complaints, caused by the sudden transitions from heat to cold.

After remaining three weeks we re-embarked our scorbutics, some of them quite recovered, and others much better. On
the

the 31st of October we sailed for the Cape of Good Hope ; our passage was as favourable as we could have wished ; we were only twenty-five days till we came to anchor in Table Bay. During this period I need scarcely add, we were tolerably healthy. The only complaint that was troublesome was the dry belly-ache.

While we lay at the Cape we had no reason to complain of the health of the ship. Such of the convicts as had ulcers were again relieved by the fresh vegetables put in their broth, and the other little comforts which they received here. I may observe, that they had taken large quantities of bark to little purpose ; and the quantity of spruce beer or essence of malt allowed them was too small to have any effect.

We

We failed from the Cape on the 23d of December, *no* better provided with antiscorbutics than we had been from other ports. After we had been three weeks or a month at sea, the ulcers began to break out afresh. In the latter end of January and beginning of February, between thirty and forty convicts * were in a deplorable situation. The ulcers were covered with a black coagulum, and discharging great quantities of blood of a black colour, at each dressing, and several were afflicted with dysentery at the same time. At this period the allowance of water was very short; as the sick and healthy all remained in the same place, it too often happened that the stronger had the greater share of it, while the poor de-

* What a pity it is, that some physician of abilities and character should not be deputed by government to inspect the medicine chest and other necessaries that ought to be carried to sea in these ships.

T. T.

bilitated wretch, unable to move from the posture in which he lay, saw, what he thought his greatest comfort, taken away from him by a rascal, under pretence of doing him some friendly office. In this situation what availed the contents of a medicine chest, or any relief that we could give him ? The weather during this part of our passage was generally favourable ; we had however a gale of wind which lasted three days : it increased our distress. On the 6th of February we made the land (Van Dieman's Land) and on the 14th came to anchor in this harbour.

The soldiers were in general very healthy : after leaving the Cape only two of them had ulcerated legs, and, though I doubt not, might be tainted with scurvy, yet after a few dressings the ulcers became clean, and were quite well before they landed.

landed. It must be observed, that the soldiers while in the different ports lived well, and always had money to procure themselves refreshments. As I did not fail to point out to them the advantages of a vegetable diet; many of them, besides tea, coffee and sugar, laid in a stock of pumpkins, oranges, &c. which I have no doubt were the means of keeping them free from this formidable disease.

Only one woman had symptoms of scurvy during our passage, it was an ulcer on the leg; she was the *most corpulent woman* in the ship.

From this sketch you will see the alterations necessary in *some* of the transports sent out to this country. The number embarked in the Pitt was too many by one-half. The apartment for the convicts might
have

have been ventilated without communicating with the soldiers and sailors. The ship was too full to carry a sufficient quantity of water; this likewise prevented her from being kept clean. A vegetable diet might, at less expence, have been allowed the convicts in the different ports; the sick might have been separated from the healthy, &c. &c.

When the fever raged on board, the gun-deck was so crouded, that it was a business of great difficulty to go round among them even in good weather.

Although I do not believe the true remittent fever infectious, yet I thought some cases on board the Pitt, approached to that species of fever arising from *human efflu-
vium*; could they be joined in the same patient?

tient? A fever resembling the jail fever raged on board the Pitt among the sailors, after the foldiers and convicts were landed. It difappeared after the fhip was cleaned and fumigated.

The Royal Admiral, another Indiaman, arrived here fometime ago. The fcurvy had made its appearance on board of her foon after fhe crossed the line, but had been kept under by great attention to cleanlinefs, &c. She had plenty of cyder and porter on board, of which Captain Bond gave the fcorbutics a good allowance. He told me he had made a comparative trial between the former and the effence of malt, and found the cyder patients recover much fafter than the others. This fhip was two hundred tons larger than the Pitt, his numbers fewer, and his paffage quicker (feventeen weeks). He fent his fcorbutics on fhore at the Cape.

I think

I think the East India ships have many advantages, (if not crowded as we were) over the small transports. They are in general dry, well aired, and their provisions good.

I may likewise mention the *Britannia*, Mr. William Raven, late master of the Duke, Commander : she arrived here after a passage of five months, in perfect health, and without having lost a man in the passage. He touched at Bona Vista, and did not see the land again till he made this coast. Too much praise cannot be given to this gentleman, for the attention he pays to the health and happiness of his ship's company: he had no surgeon on board: I believe the directions to be found in Cook's Voyages were strictly followed. He told me, that he had been longer out of sight of land in this passage, than ever that cele-

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brated

brated navigator had been in any of his voyages. On examining his Journal, I found that he had nothing but gales of wind from the longitude of the Cape of Good Hope to this place. During his stay here, he had his ship smoaked with sulphur and charcoal; not only to make her wholesome, but to kill some rats on board, which it did effectually. Two of his men not aware of the danger of going between decks, too soon after the hatches were opened; on descending were seized with giddiness, which was soon followed by abolition of consciousness, &c. Luckily one of them staggered near one of the hatches, where he was heard to fall. They were immediately got upon deck; one of them had no appearance of life when brought up. I was sent for, and had the satisfaction to recover them both, by the means commonly used. Those which I most depend upon were, inflation of the lungs

lungs with fresh air, bleeding in the jugular, and stimulants. It was nearly a week before they recovered, from a debility something similar to that in scurvy:

Is there any thing noxious in carbonic acid, and azote gas; or is it merely from the absence of oxygene, that the animal dies?

If the debility in this case; depends on the absence of vital air, may not that in scurvy, (according to your Theory) depend on the same cause?

Does the muriatic acid, as combined in sea salt, take from the system any of its oxygene, and thereby become oxygenated muriatic acid?

Or, admitting your Theory to be just, would the animal process, discharge from oxygenated muriatic acid its extra quantity of oxygene ;—or, as it may be neutralized in this state, would it be of use given in scurvy, by affording oxygene to the system ?

We know that both carbonic acid and water, are decomposed by vegetation : is it certain that animalization has not this effect ?

I am informed, that many of the transports which arrived here before we did, were in a worse condition than we were with scurvy. I have not been able as yet, however, to get many of the particulars, relating to these, which I hope to transmit to you in my next.

In

In attempting to give you an account of diseases of this colony, I must as yet speak with great diffidence : I do not think it would be fair to attribute many of the complaints that we have among us to the climate. You will, from what I have said of our passage, allow, that some foundation is laid for disease among the convicts on board the transports ; and I am sorry to add, that we have not the means of correcting the scorbutic diathesis after they are landed here. How inadequate are a few hospital stores to answer this purpose ? or even the common pot herbs, unless made into soup with fresh meat, which is not here to be procured ? instead of this, the poor wretch must boil his allowance of greens (if he can get any) with a scrap of pork or beef which has been four or five years in salt. The scurvy in this country, as well as on the passage, is accompanied with dysentery,

which frequently ends in lientery; in which case, this kind of food passes through the intestinal canal without any part of it being assimilated. The same thing happened with the Indian corn, which, from having no mills to grind it, was only bruised; are we therefore to attribute all these complaints to the climate of New South Wales? — Surely not.

I have mentioned above, that the soldiers were landed free from scurvy, or nearly so: they likewise, from the attention of their officers, live better. We may therefore, I think, with more justice, take *their* complaints as specimens of the diseases of this climate.

From the descriptions, already published, of this place, it would only be encroaching on your time to repeat any part of them.

I shall

I shall only observe here, that the situation of this place, is dry and well aired; only, the barracks where the soldiers are quartered at present, are too near the watering place; and being situated on the side of a hill, with earthen floors, the moisture continually descending from above, keeps them damp. This I think has aggravated the diseases of the military at *Sidney*. I have observed sickness follow heavy rains: this, however, will soon be obviated, as barracks are now building on the top of the eminence, to the westward of the town, where they will be perfectly dry, and fully exposed to the sea breeze.

The town is watered by a spring, or small rivulet, arising from a swamp, about five hundred yards to the southward. This water is good, being free from mineral impurities.

purities. In 1791, the spring arising from the swamp was almost dry.

I do not observe, that the exhalations from it have been the cause of sickness in the town. Intermittents, or remittent fevers, I have scarcely seen. If any thing noxious arises, it must be carried to the S. W. of us, by the sea breeze in the summer time.

The climate, from what I have seen of it, is not only a pleasant one, but I think healthy, as far as does not depend on our mode of living. The summers I must allow are very hot: the general sweep of the thermometer at this season, is from 70° to 80° ; but it sometimes exceeds this, and even approaches near 100° . This is when the wind blows from the north and north-west;
from

from which circumstance we conjecture that large tracts of sand are to be found in these directions. Luckily for us, however, it is very seldom that we have the wind from that quarter. During the summer, a very pleasant sea-breeze sets in from ten or eleven in the morning till the same time in the evening. When the weather is sultry, we generally have thunder and lightening in the evening, with sudden gusts of wind from the southward, which renders the atmosphere cool and pleasant. We do not distinguish any particular rainy season here. During the months of July, August, and September last, we had frequent rains; and this summer, so far, has been very temperate. The winter, which is the pleasantest season of the year with us, commences about May. The nights are cool and the days are temperate. A thin pellicle of ice, is sometimes formed upon the little stagnant
pools

pools at night, when the sun is at the greatest distance from us. The grass is covered sometimes with a hoar frost, which soon disappears as the morning advances; and the sky is in general clear, not a speck to be seen in it, for weeks, or two months together. This imparts a cheerfulness to the mind, seldom experienced in the northern hemisphere. In the winter season, too, many of our most beautiful trees and shrubs are in blossom.

I expected to have sent you an exact meteorological register since my arrival here, but unfortunately my thermometer was broken soon after I landed: I have however got another from the Royal Admiral, and hope I shall be able to send you a regular account of the weather in future.

The

The endemic of this place is dysentery: this disease raged among the soldiers last autumn, soon after we landed; it was particularly severe on the *new-comers*. The weather at this time was very hot in the days, with some showers of rain in the evenings: the disease was generally ushered in with shivering, succeeded by hot and cold fits. The diagnostic symptoms soon followed; the griping was in general very severe; many had sickness and vomiting of bile. The patient generally began to discharge blood in his stools, on the second or third day from the attack. The pulse was fuller, and more inflammatory diathesis prevailed than I expected to have found in an autumnal disease. If the disease run on, which it did from necessity in a few cases, the quantity of blood discharged was really astonishing.

An

An emetic was generally given in the beginning ; in those cases where the patient complained much of sickness of stomach, it was never omitted. As laxatives, the neutral salts in small doses, were found to answer better than any thing else. The patient was ordered to drink freely of barley water, or Arabic emulsion : a gentle perspiration was brought on as soon as possible, and a full dose of laudanum was given after the operation of the laxative. If the perspiration was not free, the anodyne was given in form of Pulv. Doveri, or Tinct. Opii, with Vin. Antimon. I generally ordered the patient to wear a flannel shirt next his skin, and flannel socks upon his feet : I think I have seen the best effects from it, and was continued during convalescence.

The purgative I generally used was an ounce of Sal Glaub, or Rupellen, dissolved
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in a quart of barley water, with half an ounce of manna: this was taken in the course of the day; sometimes a little Tart. Emet. or Vin. Antim. was added; it never failed to relieve the Tormina, after the first evacuations it procured. The patients frequently recovered without the use of any other medicine but this, and the opiate, at bed-time, which was never omitted.

When the tenesmus was violent, the Enema ex Amylo c. Tinct. Opii, was generally effectual in relieving it.

I was not afraid of using opium liberally in the manner above described. I confess I never found “Paralysis of the bladder, *Strangury, injuries of the Nerves, &c.*” follow the treatment above mentioned; on the contrary, out of near one hundred cases, which I treated nearly in that manner, very
few

few of them advanced to the second or chronic stage of the disease.

Two of the soldiers died of this complaint: the one was a man, who was always drunk when he could get spirits, even when in the sick list. The other was a young man of a very plethoric habit, who concealed his complaint till it was too late to prevent mortification of the bowels; he was sent to the general hospital where he died in a few days.

When nothing remained but a diarrhæa from weakness of the bowels, the bark was given in infusion or decoction, sometimes joined with Flor. Cham. They could not bear the bark in substance. Wine was allowed them at this time.

I have

I have been induced to use opium more freely in this disease, from some hints you gave me of it before I failed: to prevent any bad effects from it I used the saline laxatives more freely, perhaps, than I should have otherwise done; and I must confess, that this plan succeeded beyond my expectations.

This disease made its appearance again last spring; it was not so general, but attended with symptoms highly inflammatory. I began the cure, therefore, with bleeding, and was obliged to repeat it more than once in other cases: the other part of the treatment was nearly the same as above mentioned, and attended with equal success.

It is beginning to make its appearance again at this period, I may, therefore, have

an opportunity of mentioning it in my next.

True inflammatory fevers were frequent during the spring; they were sometimes without, but more commonly attended with, topical inflammation.

I may likewise mention rheumatism, which happened at this season: although this complaint was not very common, I saw a few cases of it as obstinate as any I ever remember to have seen before.

I think this climate is favourable to parturition. I have had considerable practice in that line, and have generally found, that nature accomplished this process sooner than in colder climates.

As

As many of the diseases here proceed from obstructed perspiration, I have proposed a very simple contrivance, to convert the common still of the hospital occasionally into a vapour bath, to be used in the beginning of dysentery, rheumatism, &c.

I have not as yet had much experience of the medical effects of the products of this country. The principal of these are the red and yellow gums, essential oils, &c. and a plant called the sweet tea.

The red gum, or more properly resin, is a very strong astringent, approaching to the nature of the *Gum. Rub. Gamb.* I have no doubt but it may be found useful in some cases, but I have never ventured to use it in dysentery. It is produced in great plenty by the large trees, which cover almost the whole face of the country.

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The yellow gum, or gum-refin, is the produce of a kind of grafts tree; it is said to be a pectoral, and to be useful in some states of dysentery. I cannot speak of this from my own experience.

The sweet tea is a small creeping plant somewhat resembling our *Hedera Terrestris* in appearance. The infusion of the leaves is sweet, with a slight bitterness, something like an infusion of liquorice with a few grains of columbo in it. I have observed it to be a strong diuretic: it is used by some instead of tea and sugar; I think it has been useful to scorbutics.

The only vegetable acid we have found, is that of a small green berry, on a bush, something like our broom. I think the acid is nearly as strong as the lime; I therefore hope it will be found useful in scurvy.

It

It does not appear to me that it has yet been tried in that disease. I evaporated some of the juice to the consistence of honey; in that state it answered very well in making punch: it likewise makes a very good jelly when boiled with twice its weight of sugar. To determine its antiscorbutic effects, I recommended to Mr. Raven of the Britannia, who sailed for the Cape, being chartered by the officers of this *corps*, to take a quantity with him, as no other vegetable acid is to be procured here. He had six gallons of it boiled, with an equal quantity of molasses, to a thick consistence, which he promised to use according to my directions, if the scurvy made its appearance.

Several of the shrubs of this country abound with essential oils; one very much resembles our peppermint, and we use it in

the same cases, but do not think it so grateful to the stomach as the English pepperment: if given in too large doses, it excites nausea and vomiting.

I have lately discovered an oil, resembling that yielded by our rosemary, and another with the flavour of the nutmeg, but have not had time to try their medical effects.

The climate at Parromatta, a settlement at the head of the harbour, is not so favourable, I believe, as at Sidney; being more distant from the sea it is hotter, and has not the advantage of the sea breeze.

I have not time to enter into farther particulars upon this and some other subjects,
which

which in my next shall be better explained,
as the Atlantic is at this moment getting
under weigh.

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I am,

DEAR SIR,

Yours sincerely,

EDWARD LAING.

THE

THE Channel fleet since April, has not afforded me any experience in this disease. The only two cases which I have seen, were shewn me by Mr. Ballentyne, surgeon of the Colossus : they speedily yielded to lemon juice. This uncommon escape from the ravages of a malady, formerly more fatal to seamen than any other, is in part to be attributed to short cruizes, but more to the improved modes of discipline in all our ships. We have also, this season, been liberally supplied with sugar and lemon juice, and their good effects have been every where conspicuous. What was used in the Channel fleet, was originally intended for the squadron under the command of Vice Admiral Sir A. Gardner, who has set an example worthy of general imitation. This measure was strongly recommended in my former work : and it affords me much satisfaction

tisfaction to have witnessed its beneficial effects. With these articles the grog was made into punch, of an excellent quality. Our ships may always be provided with lime or lemon juice, at a small expence, and we are now assured that it may be easily preserved as long as required.

It has long been a general remark, that the King's beer is one of the best preventives of scurvy with which we are acquainted, and it seldom makes its appearance till the beer is expended. The allowance of this beverage is a gallon a-day, because it is very weak; and for this reason it cannot be preserved in warm weather. A ship is seldom able to take more than three or four weeks beer to sea; after the expenditure of which, wine or grog is served out. It would certainly be a very great improvement in victualling the navy, if the Com-

missioners would order the beer *for sea use*, always of double strength, and let only two quarts be issued instead of four. In summer, or when ships are ordered abroad, a larger proportion of hops might be added to make it keep. By this change, a man-of-war going to the East or West Indies, would be able to take eight weeks beer, and by serving it alternately with wine or grog, it would be sufficient to last the longest passage. I detest the idea of allowing seamen spirits and water; and I apprehend there are few officers who ever wish to see any thing drank by the people but wholesome malt-liquor. But this alteration would interfere with no forms of office, and would be a source of much saving to government. The quantity of beer condemned last summer in the Channel fleet exceeds all calculation, and it might have been all saved had this plan been adopted. This was also recom-

mended

mended to the Victualling Board in my former work.

Lately, in conversation with Lieutenant Brown, now in the Prince of Wales, I have been informed that he had often seen raw potatoes given with great success in scurvy. This gentleman sometime ago commanded a ship in the Southern Whale Fishery, where he found them of much benefit. During a long passage home, and before he reached the Channel, this disease made its appearance among his seamen: one man had it in the most inveterate degree, which was completely cured by potatoes procured from the island of Scilly on his way. His method of using the root is to cut it in thin slices, and to eat it as we do a cucumber, with pepper and vinegar. I am always happy to bring the name of an officer forward in this manner; it bespeaks a heart feelingly

feelingly alive to the distresses of the people intrusted to his command, and intitled to his protection.

It may be worth while to observe, that the juice of a raw potatoe, in taste very much resembles that of some of our worst winter apples. It possesses a considerable degree of acidity, and very quickly oxidates iron. From its being so much like the malic acid, the French have therefore, with some propriety, called it *pomme de terre*.

It may, perhaps, be matter of regret, that in all the situations where I have met with this disease, I have never been able to furnish my reader with the account of any dissections. It is not likely now that it may ever be in my power. The prevention and cure of scurvy are so well understood, and
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the means so easily commanded, that it can be nothing but the grossest indifference and neglect that could permit a fellow-creature to perish under it.

A work intituled *Dermato-Pathologia*, or *Observations on the Diseases of the Skin*, with *Remarks on the late Theories of Scurvy*, has been published by Dr. Jackson since the second edition of my *Observations*. Few of the arguments brought forward in this ingenious volume affect my general conclusions. It might perhaps be little material, whether we admit an accumulation or over-proportion of *azote*, *hydrogene*, or *carbone* in the blood, or an abstraction of *oxygene*: they may be in the inverse ratio of one another: as the body is deprived of
its

its oxygenous principle, the others will predominate. Our theory is founded on the phenomena of the disease, which evidently shew the privation of *vital air* by the colour of the blood, the bloated countenance, torpor of the muscular fibre, &c. This privation of *vital air* we suppose more owing to the deficiency of recent vegetable matter, than any effect from the other remote causes; because, by throwing in this matter in the form of the acid fruits we can effectually cure the disease, although all the other remote causes are left to act in their full force. Our pathology and method of cure, therefore, reciprocally support and confirm one another, since pneumatic chemistry has fully demonstrated that the acidifying principle is the same in all bodies that possess that quality. It still, however, remains inexplicable, why the native acid of vegetables *alone*, with certainty, cures the scurvy in all its stages.

With

With respect to the mode of cure which Dr. Jackson has proposed from this theory, I have not yet tried it ; but I have been informed by Dr. Hope that he had given the cortex quercus in cases of scurvy, while he was surgeon of the Queen, according to Dr. Jackson's instructions, and that it had failed in all of them.

There is no disease has afforded so much scope for speculation as the one we are now treating of. It was putrefaction with Pringle ; privation of fixed air with M'Bride ; weakness of the digestive organs, and want of nourishment with Lind ; debility of the moving fibre with Milman ; the evolution of a super-abundant ammoniacal salt with Cullen ; and we, to account for it on more novel discoveries, have tried to demonstrate that it is the abstraction of oxygene from the system. I presume not to promise my
 opinions

opinions a longer reign than those of such illustrious predecessors ; but at the same time I should be considered a cold and unfeeling inquirer was I not to attach some confidence to the connection of a beautiful system in physics, with the practice of the healing art. However I may have occasionally indulged ideas of theory, it has been my invariable rule to adhere to that treatment at the sick-bed which unbiassed experience had approved. I am now to take leave of a subject that has engaged much of my attention ; it has occasionally amused and some times perplexed me. If I have been placed by Providence in situations to see and hear more of the disease than usually falls to the share of one physician, where I have failed in ability I hope it may be made up with the patience and perseverance required in the investigation. It is of vast importance to the welfare of our
 navy,

navy, that some person should attempt to cherish the spirit of enquiry ; when it ceases to exist every where, the service will suffer. The period of war affords an extensive field for observation on diseases but little known in the tranquil scenes of life ; and if it passes unimproved, much information must be lost to science, and much instruction to secure mankind from the afflictions which are attendants on a state of hostilities.

In compiling a work to lay before the Public, it is a pleasing circumstance, after having been employed for ten months in the Channel fleet, to find that we are not likely to meet with much experience on scurvy, in the ships which compose it. There is, indeed, throughout our whole navy a spirit
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of improvement as connected with health : this is no where more conspicuous than in the cleanliness of the men themselves, and also the ships. Officers are accustomed to look more narrowly after their people's health : we know them of the first distinction that are examples of this, and all our Captains are in the habits of visiting their men at the hospitals occasionally. The diet of the sick has lately been revised, and altered for the better. It will be recorded to the immortal honour of the present Board of Admiralty, that nothing has been with-held that can add to the comfort of our seamen. The easy access to the Commander in Chief and Captain of the fleet, with their ready compliance to every proposition that concerns health has made my professional and official duty a pleasure.

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The last campaign of the Channel fleet has also been marked by a survey of the Royal Hospital at Haslar, by Flag Officers and Captains; Admirals Caldwell and Gardner, with Captains Dornet and Nichols, were employed in this benevolent service. With much humanity, minuteness, and attention on the side of the officers, this business was conducted. Some beneficial changes have already taken place, and others of the first importance have been recommended.

The utility of an hospital ship to attend the Channel fleet, has also been demonstrated. Several ships have been saved from contagious fevers by speedily moving the infected. No less than five ships of the line have been cleared of the small-pox by a timely separation; in some of these near a hundred were found who had never had the disease. After the action of the first

of June, we had it in our power to afford many of the wounded men hospital bedding, who could not be moved from their ships; others were supplied with various articles, which, had they not been procured, might have proved fatal to numbers. In the latter part of the season, the *Charon* was chiefly employed in carrying the sick from the fleet in Torbay to the hospitals. These advantages would, however, be much extended was a larger ship appropriated for this purpose.

The diet in the hospital ship has also been bountifully increased by the Admiralty Board. We are now enabled to carry to sea, live-stock, vegetables, and fruits of all kinds in season: pickles of every description should the fresh stock fail: eggs, which are made into custards, puddings, &c.; tea, and patent cocoa; bread baked daily; flummery,

mery, with wine and sugar, a constant supper; wine, London porter, &c. A sea hospital in point of diet seems incapable of much farther improvement. These articles are varied in quantity and quality to the desires of the sick, and not as we have seen it, more to the convenience of a steward and his assistants, than to the comfort and relief of a patient. It is our duty to consider seamen as a body of men little accustomed to the variety, and seldom or never to the luxuries of *good living*. In the bed of sickness, therefore, the dainties and comforts of diet may be administered to them with double advantage. Much conjecture, I well know, there often is in prescribing and exhibiting medicines, and much pretended grace is assumed to persuade mankind to suffer the deception; but there can be no conjecture or random practice, I am equally well aware, in indulging the long-

ing appetite of a sick man with any delicacy of food that he can relish. In the days of ancient Rome, a dietetic physician had a department in the profession entirely to himself, and in our days it occupied much of the medical instruction of Dr. Cullen in his *Materia Medica*. But in a public hospital to stand by the bed-side of a patient craving for something he thinks he could eat, and coldly tell him that the rules of the house deny it, displays not only an unmanly indifference, but a pityful idea of the prerogatives of medicine. When it is considered what this country owes to her navy, that that navy is to be manned, navigated, and fought by healthy seamen, there can be nothing too good for them when they are diseased. After witnessing what they have lately achieved, who can be a cold advocate in their cause? The kingdom at large partook of
their

their enthusiasm; it was not followed by empty applauses, or proffers of reward; but a subscription, bountiful as it was charitable, and general as it was beneficent, repaid the wounds of our officers and seamen. It is deeds like these that bind the officer and sailor to one another, and both to the service of their king and country. It is enriching the soil to give deeper root to the oak, and must render the navy of Britain invincible.

CASE OF A BLUE BOY,
WHO DIED AT THE
ROYAL HOSPITAL, HASLAR,
IN FEBRUARY 1794.
WITH THE
APPEARANCES ON
DISSECTION.

THOMAS CARAT LEWIS, Captain's servant on board his Majesty's ship London, Æt. 14, was sent on shore on the 8th of January. Fever was marked upon his ticket, but the seat of his disease was within the thorax. He was rather of a gross habit of body, and his head was large

for his size. His pulse was about 100, rather full, and always intermitted every fifteenth stroke, his appetite was scarcely impaired. He had been more or less subject to a difficulty of breathing ever since he remembered. He had no palpitations of the heart, nor was there any laborious heaving of the breast. He was subject to worms, and vomited a large one of the terres kind; after this he took various anthelmintics, but no more came away. The most singular circumstance in the case was an unusual livid or purple colour of his countenance, neck, and hands; it was even over the whole body, but much darker in some parts than others, particularly in the cheeks and lips. His hands felt cold to the touch, and when he sat out of bed could not keep from the fire; at last he could not lie down but on the right side, and occasionally suffered great anxiety and pain.

Symptoms

Symptoms of hydra thorax now appeared, and a general anasarca followed. Wherever the water distended the skin, the livid colour disappeared, but in the face and right arm and hand it was evident to the last. He died on the 14th of February. The thorax was opened in my presence, by Mr. Meany, one of the assistant surgeons.

DISSECTION,

The right cavity of the thorax full of water, not discoloured ; no fluid in the left. Right lobe of the lungs very pale coloured. One of the left lobes variegated with large livid spots ; pericardium full of water ; coronary arteries very much distended, as if injected with wax. Slight adhesion of the pleura on the right side ; both cavas very much distended with blood ; inferior lobe
of

of the right lung, firmly attached to the diaphragm. Large concretions about the size of a pullet's egg in the right auricle, from which the auricle itself was greatly distended. This substance appeared like rennet or the dressed sweet-bread of a calf, and had two or three small cavities. In the right ventricle were found two vesicles like hydatids, near the opening of the pulmonary artery, each about the size of a large oval bead. The other cavities were natural.

I shall make no comment on this singular case, but leave the pneumatic physician to account, whether this obstruction in the cavity of the auricle, was the cause of the blood not being duly oxygenated by the lungs, as appeared from the blue colour of the boy.

THOUGHTS

THOUGHTS

ON THE

DECOMPOSITION OF WATER,

AND A METHOD FOR PREPARING CASKS
TO PRESERVE IT AT SEA ;

AND TO

KEEP MALT LIQUORS, WINE, SPIRITS, &c.

WHILE employed on the last edition of my Observations on Scurvy, I wrote the following letter to the Society of Arts, Manufactures, and Commerce, on the subject of seasoning casks for preserving water. I shall

shall re-publish the letter, not merely because it connects my opinions, but because it shews the first idea of an attempt to reduce a theory to practical advantage.

Duke, Portsmouth Harbour,
January 12, 1792.

S I R,

Having just heard of the Society's proposed premium of a gold medal, of fifty pounds, for the best account, verified by satisfactory trials, of an efficacious method of preserving fresh water sweet during long voyages, at a time that I had turned my thoughts to the subject, in finishing a second edition of my Observations on Scurvy; I am therefore induced to offer you a few remarks on this important enquiry.

It would be endless for me to recount the various conjectures of philosophers, and
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the numerous experiments of chemists that are to be met in books on this investigation. Suffice it to say, that till lately their labours have been fruitless. The subject has now assumed a new appearance, and where the famous Lavoisier, and his learned associates have left off, the present enquiry ought to begin.

If it has been proved, as I apprehend it is as clearly as any chemical fact whatever, that water is no longer to be considered as a simple elementary body, but a compound of two kinds of air, viz. vital and inflammable airs, as commonly expressed: this composition, and their decomposition, which depend upon the laws of chemical attraction, certainly point out to us very novel ideas for preserving it pure and sweet in long voyages. It is well known, that glass vessels, when close corked, or earthen jars, when

when well glazed and stoppt, preserve water for any length of time. Now, what does this depend upon? The water is incapable of acting on these substances; it finds no substance that has a stronger attraction for either of the gasses of which it is compounded, than they have for one another. In this manner it remains sweet, and would remain so for ever. But if it is put into a wooden cask, and particularly a new one, very different phœnomena take place. Water is of itself incapable of fermentation in any situation; but the changes which take place in the fluid in a cask at sea, are to be easily explained.

On opening the bung of a cask where the water stinks, a volatile elastic vapour is immediately set at liberty; a putrid smell is perceived, and if a lighted candle comes in contact

contact with it, it takes fire. This elastic vapour is nothing else but inflammable air, or the hydrogenous gas of the new nomenclature. The manner of its disengagement is shortly thus: the wood possesses a large proportion of carbonaceous matter, which attaches the oxygene of the water, and leaves the hydrogen free. Fixed air, or carbonic acid, is, therefore, constantly generated in a cask of stinking water; this is proved by adding a little quicklime, which combines with the acid, and is thus reduced to its original state, limestone.

Now this description sufficiently shews the futility of former reasoning on the subject, and from it too we learn, that no substance added to the water, at least any that is yet known, can either preserve or recover it. The only method yet invented, is by exposing it to the atmosphere, as by
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the machine of Lieutenant Osbrige. This process also confirms our explanation, for the hydrogen is either dissipated, or attracts oxygen from the surrounding air to restore sweetness to the water.

Since we find that an old cask preserves water better than a new one, it is more than probable, that what is commonly called *seasoning*, is nothing more than exhausting the principle in the wood which favours the decomposition; and I am apt to believe, that by imitating this process there is a possibility of rendering wood equally fit for preserving the fluid sweet as porcelaine, glass, or earthen ware.

For this purpose I would recommend the staves of the casks, when ready to be put together, to be steeped for a length of time in a pond filled with water; this ought to be allowed

lowed to stagnate so as to favour the decomposition of the water. The sooner, therefore, the pool becomes putrid, and the longer time that the wood is immersed in it, the more perfect will be the *seasoning*.

Had I undertaken experiments of this kind as a candidate for the prize medal of the Society, you will observe, from the nature of the subject, they could not be fully decided in the time you have appointed. I would beg leave to suggest it to the consideration of those gentlemen who conduct your chemical department, whether, from the late rapid progress of experimental philosophy, there would not be some propriety in changing the statement of the question. From the experience which I have had of a sea life, I cannot hesitate a moment in declaring this to be the most

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eligible

eligible method. There were many instances during the late war, where, ships on foreign stations, by having well seasoned casks, and having never been under the necessity of unstowing their holds, found the water pure and sweet, as when they left Spithead. But unseasoned new casks will spoil the water in ten days or a fortnight; oak casks have also, from the hardness of the wood, been preferred to all others.

If what has been said is at all consistent with matter of fact, from the representation of your most respectable Society, I have no doubt but the Commissioners for Victualling his Majesty's Navy, might be persuaded to order some experiments to be made for seasoning the staves in the manner directed above; such a representation, I apprehend,

apprehend, would be little attended to from an individual.

I am, SIR,

Your most obedient,

And humble servant,

T. TROTTER.

*To the Secretary of the Society of Arts,
Manufactures, and Commerce, London.*

The above letter was immediately honoured with the attention of the Society, and a copy of it transmitted to the Com-

missioners of Victualling, who gave me permission to make experiments for the purpose on their premises at this port. My experiments commenced in February, and finished in July: they were prematurely broke off by being unexpectedly superseded from my ship four months before the period usually allowed by the Navy Board for guardship time, in order that the surgeon, which Lord Hood applied for, might be appointed. The summary of them as detailed in another letter to the Society, will best demonstrate their utility.

Newcastle, Nov. 1792.

S I R,

I have now to acknowledge your letter, informing me, that the Society had transmitted a copy of my letter, on preserving water in long voyages, to the Commissioners
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of Victualling, and requesting them to order some experiments to be made; which request they have complied with, and also granted permission for me to make other trials on their premises, at Weevil. The result of my enquiries, I have now the honour to transmit for the information of the Society.

From my reasoning on the subject you would observe, that I had availed myself of an æra in chemical philosophy, that had thrown fresh light on the business. I mean the decomposition of water. It appeared to me, from practical observations, that something was given and received between the cask and the water; or, as chemists would speak, there was an elective attraction between the two substances. One part of the water joins itself to a part of the wood, while the other part of the water is

K 3 disengaged,

disengaged, and gives the bad smell. The word putrefaction is no longer the language of this investigation, any more than as expressing a disagreeable smell.

The preservation of water in casks, is, therefore, to depend either on something laid over the surface of the staves, or something is to be extracted from the wood that favours the separation of hydrogen and oxygen, the constituent principles of water. We have heard of water being kept in glass flasks, hermetically sealed, for fifty years, and shewn by a professor to his pupils in great perfection and purity*. The Bristol water, which is often carried abroad on account of its purity, is only found tainted when it comes in contact with the

* See the Introduction to Goldsmith's History of Animated Nature.

cork, which, though a small surface, is sufficient to spoil the whole.

The idea which first struck me in this business of immersing the staves in stagnant water, though just, as matter of fact, yet was of difficult application in practice. Water was allowed to stagnate in new casks for some time; but the inner surface did not acquire that *coating*, which we call *seasoning*, in a period short enough to be practised on a large scale. Soon after I had begun my experiments; the Crown of 64 guns, after being three years in India, arrived at Portsmouth. She had in her hold a number of leagers full of the same water that was taken on board at Spithead before she sailed, and they had never been broached or moved. This afforded a fine opportunity for examining whether there was any change of surface or colour to be perceived on the

inside of the casks. On opening them, it was found, that the whole internal surface of the staves (excepting a circle round the bung-hole, which is not touched by the water, but receives a different colour from the disengaged inflammable gas) was overspread with a thin black scurf about one-eighth of an inch thick, and exactly resembling charcoal. The water contained in these casks was very foul and extremely fetid. It would, therefore, appear that this process is a kind of slow combustion, carried on by the vital air of the fluid, which in time would convert the whole wood into charcoal. One of these leagers was washed clean, and immediately filled with pure water to try how long it would remain sweet. Mr. Raikes, in a letter a few days ago, informs me that it is as pure as when first filled. It would probably remain so as long as the cask would hold together.

This

This discovery gave me still more confidence in my theory. In conversation with Mr. Raikes, the master-cooper, I found that he had long observed a very material difference between a well fired cask, as he called it, and one done in the common way, for preserving water. This aged and faithful servant of the navy has not been all his days a mere mechanic, but, occasionally, in his department, an experimental philosopher. He had particularly seen this preference to a well-fired cask verified, by filling one which came from the Spanish Princessa, one of Lord Rodney's prizes, with a remarkable black inside surface; and it kept water pure and sweet for twelve months. In putting staves together, it is usual to fire them, in order to form them into shape, but it was never practised with farther views. On the contrary, Mr. Raikes showed me an order from the Commissioners

missioners of Victualling, *forbidding* the inside of the staves to be blacked in putting them together; for it was found in their office in London, that casks too much blacked tainted the water in a very short time. The result of all my experiments will show how ill informed these gentlemen must have been on a subject of such importance. Mr. Raikes also confirms his opinion by a very decisive, though simple experiment. Take two phials full of pure water, into one put a chip of stave oak, with a clean white surface; into the other phial put a piece of the same oak, with its surface blackened by fire, or slightly charred. In a day or two, the clean chip will discolour the water; and in proportion to the degree of heat in which it is kept, this water will grow darker and speedily become fetid, while the other phial with the charred chip will remain not only clear but perfectly sweet.

Casks

Casks made of the same wood, some with their inner surface well blacked, and others done in the common way, were filled with water from the same cistern, sweet and free from sediment. In about a fortnight the common casks became tainted, and discoloured; while the well-fired casks had the water not only sweet, but perfectly transparent. More than fifty experiments of this kind were done, and on casks of different sizes.

In about two months we found the blackened casks beginning to smell disagreeably. The cause of this was easily detected; the heads had never been fired at all. I now suggested to Mr. Raikes to fire the staves still more, even till a thick *charry* surface was formed over the whole, and to have the heads of the casks done in the same manner. A number of puncheons and
some

some leagers were finished in this way, and filled with water. It was limpid and sweet when I left Portsmouth, after being three months filled, and was so a few days ago. This completed all that could be wished for the purposes of service.

Let us now explain what changes take place in firing the staves so much. The wood of the cask, by this process, has its surface burned and charred; a gum-refinous matter in the oak is consumed, or expelled by the fire; this matter is what gives the colour to the liquid, so that to consume it is a valuable piece of business; the stave is every where hardened, and less liable to act on the water. The charry surface therefore appears to me to act as a coat of varnish or plaster, or as any other substance would, in defending the water from the wood. Charcoal, we well know, from
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the experiments of chemists, cannot effect the decomposition of water, unless exposed to a heat of 172° degrees of Fahrenheit's thermometer; so that in the common temperature of a ship's hold, no change is to be apprehended. Mr. Raikes moreover assures me, that this process of *charring the staves and heads* of casks in making, renders them much more durable in every climate, less liable to shrink from the hoops, and more secure from being pierced by worms. On the whole, I have seen it managed with great dexterity by the workmen at Weevil, under his direction. I quote his authority on this business, because he knows more of it than any cooper in Europe.

Tanks for keeping water, either in ships or elsewhere, will preserve their contents infinitely

finitely better by having the wood well charred.

Pure wholesome water is certainly one of the greatest luxuries of a sea-life ; without it soup, tea, punch, and drink of every kind is disagreeable. But it is probable that it is also essential to health. If our ideas of scurvy are just, it must act by depriving the system of its vital air, or throwing in a greater quantity of hydrogen than is consistent with health. I have said in my former work, that there were no experiments that had demonstrated the decomposition of water by the animal process. Dr. Girtanner, it appears, has been employed in this way, but his proofs are not yet come into my hands.

But

But it is not only for preserving water but other liquids that this method is useful; it extends to all the arts. Beer, wine, spirits, &c. will receive no tinge from the casks; and what has been a long *desideratum*, when empty they are not liable to become musty.

Great care ought to be taken in putting the casks together, that *very few or no chips* be made, for every fresh spot will act upon the water.

The appearance of the inner side of the stave, after being long exposed to water in a state of decomposition, as exemplified in those of the Crown, suggests some curious chemical reflections. The oxygene of the fluid joins itself gradually to a principle in the wood, till complete charcoal is formed.

During

During this union, a proportion of these substances is so combined as to form carbonic acid, which is always found in some degree in tainted water. It is in this very manner that we must account for the same substance, called the *choack-damp* being generated in a ship's well or hold. Defending the wood from the water by charring would effectually prevent the generation of this noxious effluvium.

Beer casks, though long in use, we found never became seasoned enough to keep water; on the contrary, even after washing, they tainted water sooner than a new cask. This is, no doubt, owing to the yeasty and farinaceous matter getting into the pores of the wood, and favouring the decomposition. This suggests a very useful lesson to our coopers in ships, always to shake beer casks before putting water into them, and
fire

fire them well in setting the staves together.

In order that no deception might attend these experiments, the whole of the casks were exposed to the direct rays of the summer sun. A contrary practice would have given very different results. A cask, similar to what remained sweet for three months in winter, when exposed to the heat of the sun in April became spoiled in a fortnight, so rapidly does heat increase the disposition to decomposition in the water.

The world has been lately amused with some experiments by M. Lowitz, on the subject we have been investigating; for two of which he has been honoured with the prize medal, from the Oeconomical Society of Peterburgh. We repeated these experiments as follows: A quantity of well

L prepared

prepared charcoal, powdered, was put into a butt of water. The cask was frequently shaken through the day in order to bring the whole of the water into contact with the charcoal. This butt was exposed to the sun in the same manner as all the others. On the tenth day the water was evidently tainted, and on the eighteenth it was extremely fetid.

Four drams of well prepared powder of charcoal were put into a glass of stinking water, which was frequently agitated; neither the offensive smell or taste were corrected by these means.

An equal proportion of charcoal was mixed with four ounces of water, very highly tinged, which had been carried to India and back again in the Crown's hold. There was no precipitation of the colour-
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ing matter after they had been mixed for two weeks.

These trials certainly shew that there was some fallacy in M. Lowitz's experiments ; and he could surely never mistake the escape of the hydrogene for its combination or absorption by the charcoal.

We are at present acquainted with no substance that can preserve water from spoiling in wooden vessels ; nor do we know as yet, whether oxygene thrown into a cask that is fetid, would immediately combine with the disengaged hydrogene, and restore sweetness to the whole. This is left for future trials. It has been thought by some of the French chemists, that hydrogene was capable of decomposing the

L 2 fulphuric

fulphuric acid, so as to disengage its sulphur and combine with its vital air. From this I was induced to make experiments with all the acids. About two drams of the sulphuric, nitrous, muriatic, tartarous, acetic, and citric acids, were each mixed with eight ounces of very stinking water from the Crown's hold. These trials were all made in close shut phials, that there might be no deception from the hydrogen flying off. No difference of smell was perceived in any of the phials, but the one which contained the nitrous acid. In all the others the fetid vapour arose as before. The taste of the water was however a little acidulous, and it smelled of *aq. fortis*. By this experiment we find that hydrogen has a greater attraction for vital air, than either of them has for *azote*, the base of the nitrous acid. I am, however, of opinion,
that

that water at sea fweentened by this acid
will not be pleafant for ufe.

I am, SIR,

Your very humble fervant,

T. TROTTER.

*To Mr. More, Secretary to the Society of
Arts, &c.*

This letter, by miftake fomewhere, I
am juft informed, was never feen by the
Commiſſioners of Viſtualing; and I have
been in expectation for two years of hear-
ing their opinion, and whether they would
order the plan to be practiſed by all their
coopers

coopers for the use of the navy. My reason for transmitting it through the Society of Arts, Manufactures, and Commerce, was merely that the chemical researches which it embraces, might be sanctioned by the authority of the Chemical Committee of that respectable body. Public Boards meet with so many applications from individuals, are supported by mistaken ideas of usefulness to the public service, that they must be cautious of attending to such requisitions. I am of opinion that this great national object is fully accomplished, by the directions I have given, and officers will now try it fairly themselves.

Some gentlemen in the navy, who had not known the nature of my experiments, have rather ignorantly condemned the practice now inculcated. When the water becomes very fetid, and has been kept some
time]

time in the same cask, the inner surface of the head and staves will sometimes become so black as to look as if they had been fired, from which I have heard it asserted, that it was owing to *charring* them in making. But we have proved that this black surface is only formed in consequence of the water spoiling ; for a cask will never assume that hue if the fluid is sweet and pure.

F I N I S.

